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# Investor sentiment and equity mutual fund performance in Brazil

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## Abstract

**Purpose** – Focusing on the Brazilian equity mutual fund industry, this study analyzes whether including the investor sentiment index in asset pricing models is important for explaining fund alpha.

**Design/methodology/approach** – The investor sentiment index and risk factors in the Fama and French (1993) and Carhart (1997) models were estimated, the risk-adjusted performance of a sample of equity mutual funds in Brazil was evaluated, and a United States (US) sample was included for a complementary perspective. The sample period spans 2010–2019 for Brazil and 2010–2018 for the US.

**Findings** – The results contrasted with those evidenced in the US, where the sentiment index was an important factor in explaining the probability of alpha occurrence, especially in the case of winner funds, defined as those exhibiting a positive and statistically significant alpha at the 5% level. Overall, the findings suggest that, in the Brazilian market, pricing models incorporating investor sentiment as an additional factor fail to adequately capture the outperformance probability of equity mutual funds. These results suggest that the factors influencing fund performance may differ between the two countries and highlight the relevance of developing more suitable investor sentiment indicators for emerging markets.

**Originality/value** – This study examines the impact of the sentiment index on the performance of equity mutual funds in Brazil, specifically its influence on alpha generation.

**Keywords** Sentiment index, Asset pricing models, Equity funds, Fund performance, Brazil

**Paper type** Research paper



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## 1. Introduction

For decades, one of the most widespread ideas in the finance literature has been that investors are rational, and therefore, stock market prices should reflect the fundamental value of future cash flows. However, several studies suggest that these assumptions do not fit the real world and that market prices are indeed affected by investor emotions and expectations (Lee *et al*., 1991; Baker and Wurgler, 2006, 2007). Moreover, a series of studies indicate that investor sentiment affects the capital market (Brown and Cliff, 2004; Baker and Wurgler, 2006, 2007; Bandopadhyaya and Jones, 2006; Yoshinaga and Castro Junior, 2012; Corredor *et al*., 2013; Firth *et al*., 2015; Bu, 2020a, b; Bitencourt and Iquiapaza, 2024).

Investor sentiment can be defined as the expectations of asset returns that their fundamentals cannot explain (Lee *et al*., 1991). It is also related to pessimism or optimism regarding the stock market in general and the propensity to speculate (Baker and Wurgler, 2006, 2007). In this sense, sentiment has been widely recognized to affect the overall financial market (Cheong *et al*., 2017; Paraboni *et al*., 2018). Nevertheless, only recent studies have focused on the possible effect of investor sentiment in the mutual fund industry, specifically, on how it can affect managers' strategies and the performance delivered to shareholders (Bu, 2020a, b; Wang *et al*., 2020, 2021).

In addition, most of these studies show the influence of sentiment on the Chinese and US markets. Recently, some researchers have investigated the estimation and influence of the investor sentiment index on the Brazilian market (Yoshinaga and Castro Junior, 2012; Xavier and Machado, 2017; Miranda and Machado, 2018; Santana *et al*., 2020; Bitencourt and Iquiapaza, 2024). However, none of these studies have considered the mutual fund industry, despite its importance in the Brazilian market. Additionally, notwithstanding this evidence, Brazilian studies are continuing to progress toward the development of the sentiment index and its effects on the market (Xavier and Machado, 2017; Miranda and Machado, 2018; Santana *et al*., 2020).

In this sense, the objective of this study is to investigate the effect of investor sentiment on mutual fund performance (occurrence of fund alpha) in the Brazilian mutual equity fund industry. According to benchmark models, in particular, the Capital Asset Pricing Model (CAPM) and the Fama and French (1993) and Carhart (1997) models, a positive alpha implies that the fund has outperformed the market, as alpha is measured by the difference between a fund's actual return and its expected performance according to a benchmark model (Jensen, 1968; Bu, 2020b). By definition, a positive fund alpha should occur only occasionally because of the efficient market hypothesis, which states that it is not possible to beat the market consistently (Fama, 1970). However, positive fund alphas are regularly documented (Bu, 2020a, b), suggesting that some important factors might be missing in standard benchmark models (Bu, 2020a). Therefore, investor sentiment is used as one of the possible missing factors, following the approach of Bu (2020b) and adapted it to an emerging market, such as Brazil.

Baker and Wurgler (2006, 2007) state that no perfect proxy for investor sentiment exists, but propose a practical approach for its estimation. This approach was adapted by Yoshinaga and Castro Junior (2012), and other studies proposed an investor sentiment index for Brazil, which was used in this study. For example, Miranda *et al*. (2018) estimate the investor sentiment index for Brazil without considering turnover because it is affected by the frequency of negotiations. Santana *et al*. (2020), who argue that sentiment is associated with financial decisions and accounting choices, suggest that it influences firms' accruals, which, in turn, influences share pricing in the Brazilian market. Consequently, discussions about the effects of sentiment on the Brazilian market have gained increasing importance in research on asset pricing models.

Equity mutual funds in Brazil were analyzed adopting a comparative approach and incorporating data from the US as a reference point. Following the methodology established by Bu (2020b), the analysis spans a decade, covering the period from 2010 to 2019 for Brazilian funds and from 2010 to 2018 for US funds. The terminal date for the US data is dictated by the last available year for the Baker and Wurgler sentiment index, which serves as a critical metric in this assessment. The obtained results were the same as Bu (2020b) concerning the US; in other words, the sentiment index was found to be a key factor in capturing the

outperformance probability of equity funds. However, the main results for Brazil suggest that benchmark models accounting for investor sentiment as an additional factor do not adequately capture the outperformance probability of equity mutual funds. In addition, the results were consistent for estimating the Brazilian sentiment index, although it is important to note that a standardized set of variables for this estimation has not yet been established.

The findings underscore the importance of further research exploring variables that predict investor sentiment in emerging markets, as they suggest the need to develop more appropriate sentiment indices for these markets. This aligns with other studies that have analyzed investor sentiment in the stock markets of developing countries (Anand *et al.*, 2021; Torre-Torres *et al*., 2021).

The remainder of this paper is organized as follows: Section 2 discusses the previous studies that helped us achieve the study goals. Section 3 describes the methodology used in this study. Section 4 presents the study results. Section 5 presents the discussion, and Section 6 offers the conclusion of the paper.

## 2. Theoretical foundations and related literature

This section discusses studies on investor sentiment and asset pricing models in relation to mutual funds in both the Brazilian and overseas markets.

### *2.1 Investor sentiment*

To determine whether the mutual fund industry takes market sentiment into consideration, Massa and Yadav (2015) investigated the mutual fund industry in the US over the period 1984–2005. They argued that mutual fund managers could use market sentiment strategically to improve their performance and indirectly attract more flows into the fund. Furthermore, they argued that funds with low exposure to sentiment tended to follow more particular investment strategies and those of active fund managers, specifically, bold and traditional strategies for allocating fund resources in response to optimism and pessimism expressed by changes in sentiment during the period. Moreover, their results showed that the funds in which managers invested more—low-sentiment-beta stocks—attracted more significant investor flows.

Jiang and Yuksel (2019) studied a sample of actively managed US mutual funds over the period 1993–2014 to check for differences in the decision-making process of investors regarding their allocation of money in some mutual funds, depending on sentiment periods (high or low). The results showed that the preference of mutual fund investors for certain fund characteristics changed depending on the sentiment period. They found that mutual fund investors tended to pay more attention to past performance, expenses, and fund visibility when sentiment was high. In addition, the effect of sentiment was more pronounced among retail fund investors than among institutional investors.

By analyzing the relationship between investor sentiment and mutual fund performance, Bu (2020a, b) discussed how investor sentiment affected a mutual fund's alpha. He explained that the probability of outperforming funds increased with investor sentiment and claimed that investor sentiment was a missing factor in the benchmark models that researchers tended to use to estimate fund performance.

Wang *et al.* (2021) observed how mutual fund managers reacted to market sentiment in the Chinese mutual fund industry. They showed that mutual funds followed the sentiment-catering strategy; that is, they attracted new flows into funds based on investors' enthusiasm for popular stocks, and this did not necessarily provide better performance to the fund/investor. Furthermore, these funds tended to incur greater risks when rebalancing their portfolios. Thus, there is evidence of an agency problem in mutual funds, with managers acting in their own interests rather than in line with the investors' objectives. Santana *et al.* (2020) pointed out that this agency problem has also occurred in Brazil. They investigated the relationship between the sentiment index and the discretionary accruals of publicly traded companies and found, specifically in a

separate analysis of periods of low and high sentiment, that managers tended to increase and reduce accruals, respectively, after changing the sentiment index of each time course.

In another study, Wang *et al.* (2020), who also studied Chinese mutual funds between 2009 and 2016, uncovered other evidence on the sentiment strategies of mutual funds. The main results showed a negative relationship among performance, fund risk-taking, and the sentiment proxy (FLOW). They argued that fund managers tended to minimize risk-taking when sentiment was high and contended that there was evidence regarding the dumb money effect. The study's findings indicate that funds contribute to stabilizing the financial market because enthusiasm for investing in funds tends to intensify managers' risk aversion, which reduces risk-taking.

*2.2 Asset pricing models*

Asset pricing models emerged in the 1960s, starting with the Capital Asset Pricing Model (CAPM). This model assesses the performance of investment assets based on the market risk. This risk is the main explanatory factor for the asset returns relative to the market returns and the returns of the risk-free asset (Sharpe, 1964; Lintner, 1965; Mossin, 1966). The CAPM postulates a linear relationship between returns and systemic risk and is based on the premises of investor rationality and market balance.

The CAPM was estimated using a simple linear regression represented by Equation (1). The Ordinary Least Squares (OLS) were used, estimated from asset returns and the difference between the average market returns and the risk-free asset returns. An asset's exposure to market risk represents the investment premium estimated according to the market risk.

$$R_i = \alpha + \beta_i\left(\overline{R}_m - R_f\right) \tag{1}$$

As an alternative to the CAPM, in which the risk estimation process is multiple and composed of macroeconomic factors, Fama and French (1993) proposed a three-factor model. They argue that, in addition to market risk, we must also consider the influences of size (SMB) and the value measured in the book-to-market (HML) on asset performance, as shown in Equation (2). In addition, for the evaluation of investment funds, Carhart (1997) added a fourth factor, the moment factor (MOM), to the three-factor model. This approach was based on Grinblatt and Titman (1993), who assessed the persistence of abnormal fund returns. This factor expresses the persistence of the return on assets over time, and the model is shown in Equation (3).

$$R_i = \alpha + \beta_i\left(\overline{R}_m - R_f\right) + s_iSMB + h_iHML \tag{2}$$

$$R_i = \alpha + \beta_i\left(\overline{R}_m - R_f\right) + s_iSMB + h_iHML + m_iMOM. \tag{3}$$

Recently, Fama and French (2015, 2016) defended a five-factor model. They argued that the pricing process should consist of the three-factor model and the factors of investment (RMW) and profitability (CMA), as shown in Equation (4). Here $R_i$ is the excess of a fund's returns estimated by the difference between the returns of fund $i$ and the risk-free asset, $R_i - R_f$. Overall, studies appraising Brazilian fund performance frequently use the CAPM and three- and four-factor models to show the statistical significance of the effect of these factors on asset performance (Borges and Martelanc, 2015; Nerasti and Lucinda, 2016; Maestri and Malaquias, 2018; Fernandes *et al.*, 2018; Silva *et al.*, 2018, 2020).

$$R_i = \alpha + \beta_i\left(\overline{R}_m - R_f\right) + s_iSMB + +h_iHML + r_iRMW + c_iCMA \tag{4}$$

## 3. Methodology

The Brazilian fund sample comprised 303 active equity mutual funds. Category selection followed the new classification of the Brazilian Financial and Capital Markets Association (Associação Brasileira das Entidades dos Mercados Financeiro e de Capitais [ANBIMA]). Indexed, foreign, and sectoral investment funds were not considered because of the particularities of these classes.

The sample period spans from January 2010 to December 2019. Only funds with complete return data were considered, as did Bu (2020b). Fund data were collected from SI ANBIMA. The investor sentiment index and the risk factors for the pricing models were estimated monthly for the Brazilian market. Data for estimating the risk factors were obtained from *Economatica*, following the procedures outlined by Fama and French (1993) and Carhart (1997). For the sentiment index, some data were collected from the Brazilian stock exchange (Brasil, Bolsa, Balcão - B3) and the Securities and Exchange Commission (Comissão de Valores Mobiliários [CVM]), while the remaining data were sourced from *Economatica*.

The Brazilian investor sentiment index was estimated using four variables: Number of Initial Public Offerings (NIPO), Individual Investor Participation (PartInvInd), Premium for Dividends (PDiv), and the High-Low Ratio (AD). NIPO was measured as the average of IPOs and Follow-ons during the previous twelve months. PartInvInd refers to the percentage of individual investors' participation in B3's monthly transactions.

For PDiv, companies were classified as either dividend payers or non-payers based on whether they paid dividends greater than zero, as reported in their financial statements. PDiv was then calculated by taking the difference in the logarithms of the market-to-book ratio for each group. The AD is the ratio of the highest to lowest stock prices over the past twelve months. These variables were selected based on previous studies (Baker and Wurgler, 2006, 2007; Yoshinaga and Castro Junior, 2012; Xavier and Machado, 2017; Miranda and Machado, 2018; Santana *et al.*, 2020). It is important to note that the discount rate variable, originally used in Baker and Wurgler's index, was not included due to its unavailability in Brazil (Yoshinaga and Castro Junior, 2012). The turnover variable was also excluded because of the high frequency of institutional investor trades, which, according to Wurgler's website, no longer reflects investor sentiment.

In the estimation of sentiment, the variables NIPO and PDiv were considered contemporary, and the variables PartInvInd, and AD lagged. This choice between the variable and its lag depended on its correlation with the first component of the principal component analysis (PCA), a method of estimating sentiment. In addition, the variables were orthogonalized concerning the macroeconomic variables (inflation, GDP growth, employment level, consumption level, and crises). The variables were obtained from the Brazilian Institute of Geography and Statistics (IBGE), the Institute for Applied Economic Research (IPEA), and the National Bureau of Economic Research (NBER).

For orthogonalization, the residuals of the linear regression of each variable of the sentiment index with the set of macroeconomic variables were used, a common procedure in the sentiment literature (Baker and Wurgler, 2006, 2007; Yoshinaga and Castro Junior, 2012; Xavier and Machado, 2017; Miranda and Machado, 2018; Santana *et al.*, 2020). All variables were validated using PCA, meaning only eigenvalues greater than one were validated (Yoshinaga and Castro Junior, 2012; Firth *et al.*, 2015; Xavier and Machado, 2017; Miranda and Machado, 2018; Santana *et al.*, 2020). In fact, the percentage of variation explained by the first component was 59%, higher than some studies pointed out; for example, Miranda and Machado (2018) calculated a proportion of 49%, like that calculated by Yoshinaga and Castro Júnior (2012). To estimate the sentiment index, seven steps were followed, summarized as follows:

(1) Estimation of variables and lags, 12-month lagged variables.

(2) Validation of the database structure for PCA using Bartlett's test and the Kaiser-Meyer-Olkin (KMO) test.

(3) PCA and evaluation of the correlation between the variables and the first principal component.

(4) Selection of contemporary NIPO and PDiv; PartInvInd, and AD lagged.

(5) Orthogonalization with the macroeconomic variables of inflation, GDP growth, crisis, and employment and consumption levels.

(6) Validation of new data using Bartlett's sphericity test and the Kaiser-Meyer-Olkin (KMO) test.

(7) Estimation of the sentiment index using PCA and appropriate variables.

For data validation, Bartlett's and the KMO tests were used, which are complementary techniques of multivariate statistics that ensure the use of PCA and the usefulness of the results. Bartlett's test validates the correlation structure among the variables, while the KMO index evaluates the magnitude of this correlation (Johnson and Wichern, 2007; Shrestha, 2021; Fonseca, 2022). Prior to orthogonalization, Bartlett's test yielded a test statistic of 1,182.50 (with a *p*-value of zero), indicating the rejection of the null hypothesis that PCA would not be appropriate. The KMO test was 0.69, also considered valid, as values closer to one indicate greater appropriateness of the technique for the data. After orthogonalization, the tests were reapplied, and the results remained consistent: Bartlett's test produced a statistic of 350.89 (with a *p*-value of zero), and the KMO index was 0.60, maintaining the previously identified adequacy.

In this study, the CAPM and three- and four-factor models are named CAPM, FF, and FFC, respectively. They were estimated with and without including the Sentiment Index (Sent) with the time series. Heteroscedasticity and autocorrelation tests were performed using residuals, and when necessary, the residual covariance matrix was corrected, as shown by MacKinnon and White (1985). The regressions were estimated for all periods and three subperiods: Jan. 2010 to Dec. 2012, Jan. 2013 to Dec. 2015, and Jan. 2016 to Dec. 2019. The results served as a basis for calculating the probability of superior fund performance (Bu, 2020b).

Outperformance probability reflects the probability that the alphas are positive and significant in the models divided by the alpha's total. Specifically, the coefficients of the winner funds (the winner funds included all funds with positive alphas that were statistically significant at the 5% level) were evaluated, sentiment was classified into high and low quintiles for analysis of the fund alphas, and the models for each quintile were estimated.

To complement the analysis of Brazil, a sample of US mutual funds was also collected for comparison, covering a period similar to the Brazilian funds. The US data were gathered as follows: mutual fund information was sourced from the Center for Research in Security Prices (CRSP) database, specifically the survivor-bias-free (Elton *et al*., 1996) mutual fund database. The sample includes US equity funds from the EDYG class. Additionally, due to the available years for the sentiment index, 2019 was not included. For the US sample, the investor sentiment index was obtained from the Wurgler website (http://people.stern.nyu.edu/jwurgler/), and the risk factors were obtained from the Kenneth French website (https://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html).

## 4. Empirical findings

### *4.1 Analysis of descriptive statistics on fund returns, sentiment index, and risk factors*

Table 1 presents the descriptive statistics of the variables used to estimate the models. It was observed that the average and median values of the measured statistics were very close. This indicates symmetry in the distribution of the values. In addition, considering the coefficient of variation with this standardized measure of distribution, it was observed that the funds presented great variation in monthly returns throughout the series. Similarly, funds are presented as mean and median positive returns in the sample period. Furthermore, the mean and median of the sentiment index were negative, showing that Brazilian investors were generally pessimistic about the Brazilian market throughout the period 2010–2019.

**Table 1.** Descriptive statistics of the variables, Brazil

| | Mean | Standard deviation | Coefficient of variation | Minimum | Median | Maximum |
|---|---|---|---|---|---|---|
| Return | 0.874 | 4.963 | 5.677 | −33.60 | 0.743 | 33.05 |
| Sent | −0.440 | 1.122 | −2.549 | −2.980 | −0.567 | 3.349 |
| Risk free | 0.008 | 0.002 | 0.275 | 0.004 | 0.008 | 0.012 |
| RMRF | −0.002 | 0.057 | −30.253 | −0.126 | −0.004 | 0.158 |
| SMB | −0.001 | 0.039 | −58.946 | −0.134 | −0.004 | 0.120 |
| HML | −0.017 | 0.052 | −3.045 | −0.133 | −0.017 | 0.122 |
| Mom | 0.020 | 0.050 | 2.487 | −0.133 | 0.021 | 0.132 |

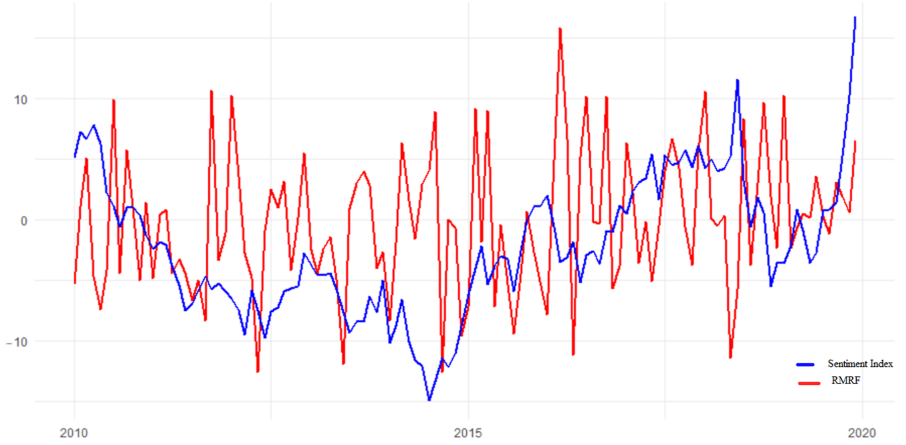
**Note(s):** Table 1 presents the descriptors of the variables that served as the basis for the measurement of pricing models. RMRF refers to $(\overline{R}_m - R_f)$. The fund sample includes 306 mutual funds. The sample period ranges from January 2010 through December 2019 (monthly return data in %)
**Source(s):** Authors' own work

Figure 1 presents the movements of the sentiment index and the monthly market excess returns (RMRF). The sample period was from January 2010 to December 2019. The sentiment index was multiplied by five to facilitate comparison.

Figure 1 shows the monthly distributions of the market premium and investor sentiment index in the Brazilian market. According to the Organization for Economic Co-operation and Development (OECD), recessions occurred in the American market from May 2012 to February 2014, May 2015 to April 2017, and August 2018 to December 2019. These periods are associated with significant fluctuations in the Brazilian market and, like Bu (2020b) attests to the US case, do not respond quickly to the variations in the sentiment index. In the case of Brazil, the responsiveness of the sentiment index to market fluctuations was determined to be too low.

*4.2 Performance and effects of the sentiment index in the Brazilian market*

First, the outperformance probability of funds was estimated, that is to say, the probability of achieving a positive alpha that is statistically significant at the 5% level, using the standard




**Note(s):** Figure 1 exhibits the movements of the sentiment index and the monthly market excess return (RMRF). The sample period ranges from January 2010 through December 2019. The sentiment index is multiplied by 5 to facilitate comparison
**Source(s):** Authors' own work

**Figure 1.** Relationship between market excess return (RMRF) and the sentiment index

benchmark models CAPM, Fama and French (1993) (FF), and Carhart (1997) (FFC). The sample was also divided into subperiods to check for the effect of the market state. Table 2 presents the test results.

Our results demonstrated that a higher probability of outperforming occurred when alphas were measured based on the CAPM model. As Table 2 shows, this probability is 29.04% against the 14.52% of the 3-factor model and 7.92% of the four-factor model for the entire period. In contrast, the outperformance probabilities decrease sharply when the estimation of alphas is based on the FFC model, suggesting that momentum is an important factor to consider for mutual fund performance analysis, as noted by other authors (Carhart, 1997; Borges and Martelanc, 2015; Nerasti and Lucinda, 2016; Maestri and Malaquias, 2018; Fernandes *et al*., 2018; Silva *et al*., 2020).

By subperiod, Table 2 shows that the outperformance probabilities vary from 27.06% to 6.60% using the CAPM, from 6.93% to 1.98% using the FF model, and from 3.96% to 1.65% using the FFC model. These results indicate that the FFC model best explains fund performance even for shorter sample periods. Furthermore, the lowest outperformance probability was in period 3 (2016–2019). Therefore, all changes in outperformance probabilities across periods indicate that market states might play a role in the probability of abnormal fund returns occurring.

Subsequently, the outperformance probabilities of funds were estimated using the standard benchmark models (CAPM, FF, and FFC) adjusted for investor sentiment. The results presented in Table 3 suggest that adding the sentiment index to a benchmark model can substantially increase the outperformance probability, excluding the four-factor model in the entire period, the CAPM model in the first subperiod, and all the models in the 2016–2019 subperiod.

The period from 2016 to 2019 was marked by great uncertainty in Brazil. In 2016, President Dilma Rousseff was impeached and several politicians were arrested as a result of Operation

**Table 2.** Outperforming probabilities based on standard benchmark models, Brazil

| | CAPM (%) | FF - 3 factor model (%) | FFC - 4 factor model (%) |
|---|---|---|---|
| Whole period | 29.04 | 14.52 | 7.92 |
| 2010–2012 | 27.06 | 1.98 | 2.64 |
| 2013–2015 | 6.60 | 6.93 | 3.96 |
| 2016–2019 | 10.23 | 2.97 | 1.65 |

**Note(s):** Table 2 presents the outperforming probability of the sample funds based on the CAPM, Fama and French (1993), and Carhart (1997) models. The fund sample includes 306 mutual funds. The sample period ranges from January 2010 through December 2019 (monthly return data)
**Source(s):** Authors' own work

**Table 3.** Outperforming probabilities on sentiment-adjusted models, Brazil

| | CAPM + sent (%) | FF - 3 factor model + sent (%) | FFC - 4 factor model + sent (%) |
|---|---|---|---|
| Whole period | 33.66 | 15.18 | 5.94 |
| 2010–2012 | 16.50 | 3.30 | 3.96 |
| 2013–2015 | 8.25 | 15.51 | 9.57 |
| 2016–2019 | 3.63 | 2.31 | 1.65 |

**Note(s):** Table 3 presents the outperforming probability of the sample funds based on the CAPM, Fama and French (1993), and Carhart (1997) models adjusted by investor sentiment. The fund sample includes 306 mutual funds. The sample period ranges from January 2010 through December 2019 (monthly return data)
**Source(s):** Authors' own work

Car Wash (Operação Lava Jato), one of the largest anti-corruption operations in the country. Nevertheless, in 2017 "[. . .] a compromising conversation between Brazil's President and an influential business tycoon was bugged and leaked by the Brazilian Justice Department, in which the President allegedly condoned bribing a key witness in the Car Wash probe [ . . .]" (Hillier and Loncan, 2019, p. 2). As this situation became public, the stock market reacted negatively with a sharp drop. All these situations contribute to elevating the level of investor sentiment in Brazil, as shown in Figure 1 and consistent with what has been discussed earlier.

Furthermore, the basic interest rate decreased significantly in 2017. In association with that, the demand for equity mutual funds increased sharply, according to data from the Brazilian Financial and Capital Markets Association (Anbima, 2020). Thus, these events may have also affected fund managers' performance.

Next, it was analyzed whether the performance of the winner funds was linked to the sentiment index. The winner funds earn statistically significant positive alphas based on a benchmark model. Table 4 reports the results of the winner fund portfolio based on the CAPM, FF, and FFC models, without including the sentiment index.

Table 4 confirms that the highest alpha is obtained from the CAPM model at 0.6%. In addition, the FFC model has the largest explanatory power for funds' abnormal returns (94.3%), followed by the FF model at 93.7% and the CAPM at 88.7%. Nonetheless, all the risk factors were statistically significant at the 5% level. Hence, the same analysis was performed using the sentiment index included as a new factor in the benchmark models, and the results are reported in Table 5.

**Table 4.** Winner funds and benchmark models, Brazil

| Intercept | RMRF | SMB | HML | MOM | $R^2$-adj |
|---|---|---|---|---|---|
| 0.006 | 0.660 | | | | 0.887 |
| (0.001)*** | (0.021)*** | | | | |
| 0.004 | 0.710 | 0.233 | −0.132 | | 0.937 |
| (0.001)*** | (0.027)*** | (0.028)*** | (0.027)*** | | |
| 0.003 | 0.728 | 0.237 | −0.101 | 0.080 | 0.943 |
| (0.001)* | (0.025)*** | (0.027)*** | (0.030)*** | (0.023)*** | |

**Note(s):** Table 4 presents the results of the winner fund portfolio based on the CAPM, Fama and French (1993), and Carhart (1997) models. The winner fund portfolio includes all funds with positive alphas, which are statistically significant at a 5% level. ***, **, and * indicate statistical significance at a 0.1%, 1% and 5% level, respectively. The sample period ranges from January 2010 through December 2019 (monthly data)
**Source(s):** Authors' own work

**Table 5.** Winner funds and sentiment-adjusted models, Brazil

| Intercept | RMRF | SMB | HML | MOM | SENT | $R^2$-adj |
|---|---|---|---|---|---|---|
| 0.006 | 0.657 | | | | 0.002 | 0.888 |
| (0.002)*** | (0.029)*** | | | | (0.001) | |
| 0.004 | 0.710 | 0.231 | −0.133 | | 0.000 | 0.936 |
| (0.001)*** | (0.028)*** | (0.029)*** | (0.027)*** | | (0.001) | |
| 0.002 | 0.728 | 0.239 | −0.099 | 0.082 | −0.000 | 0.942 |
| (0.001)* | (0.025)*** | (0.028)*** | (0.032)*** | (0.025)*** | (0.000) | |

**Note(s):** Table 5 presents the results of the winner fund portfolio based on the CAPM, Fama and French (1993), and Carhart (1997) models adjusted by investor sentiment. The winner fund portfolio includes all funds with positive alphas, which are statistically significant at a 5% level. ***, **, and * indicate statistical significance at a 0.1%, 1%, and 5% level, respectively. The sample period ranges from January 2010 through December 2019 (monthly data)
**Source(s):** Authors' own work

According to the results presented in Table 5, the sentiment index is not a statistically significant factor in the models used to estimate fund performance in Brazil. These results differ from those reported by Bu (2020b) for the US. Consequently, it is not possible to say that the chances of beating the market in Brazil change according to the market sentiment.

To confirm the effects of the investor sentiment index on the abnormal returns of Brazilian funds, another test was performed by adding the sentiment index to the benchmark models as a dummy variable. Low sentiment values are denoted by 1 and high sentiment values are denoted by 2. The results are presented in Table 6.

In line with the previous results, the sentiment level is not statistically significant for all models, as Table 6 shows. This suggests that in Brazil, the sentiment level adds no explanatory power to the benchmark models to predict a fund's performance. As an additional analysis, the outperformance probabilities were estimated by dividing the sample according to the sentiment index in the low- and high sentiment periods. The results are presented in Table 7.

Based on the CAPM and FF models, the outperformance probabilities are larger for the high sentiment period: 25.08% versus 15.84% in the CAPM model, and 7.26% versus 6.93% in the FF model. In contrast, based on the FFC model, the outperformance probability is larger in a low sentiment period: 5.94% against 2.97%. However, the outperformance probability is larger in the low sentiment period for all the benchmark models when an adjustment for investor sentiment was made, as Table 8 shows. Furthermore, the outperformance probability increases if the sentiment index is factored into the benchmark models.

Overall, the findings suggest that the benchmark models that account for investor sentiment as an additional factor do not adequately capture the outperformance probability of equity mutual funds in Brazil.

**Table 6.** Winner fund controlling for sentiment factor, Brazil

| Intercept | RMRF | SMB | HML | MOM | SENT | $R^2$-adj |
|---|---|---|---|---|---|---|
| 0.003 | 0.659 | | | | 0.002 | 0.886 |
| (0.004) | (0.029)*** | | | | (0.003) | |
| 0.003 | 0.710 | 0.233 | −0.132 | | 0.000 | 0.936 |
| (0.003) | (0.028)*** | (0.028)*** | (0.027)*** | | (0.002) | |
| 0.004 | 0.728 | 0.240 | −0.098 | 0.082 | −0.001 | 0.942 |
| (0.003) | (0.025)*** | (0.026)*** | (0.031)*** | (0.024)*** | (0.002) | |

**Note(s):** Table 6 presents the results of the winner fund portfolio based on the CAPM, Fama and French (1993), and Carhart (1997) models adjusted by sentiment level. In this case, SENT represents a dummy variable which receives 1 for low sentiment values and 2 for high sentiment values. The winner fund portfolio includes all funds with positive alphas, which are statistically significant at a 5% level. ***, **, and * indicate statistical significance at a 0.1%, 1%, and 5% level, respectively. The sample period ranges from January 2010 through December 2019 (monthly data)
**Source(s):** Authors' own work

**Table 7.** Outperforming probabilities and investor sentiment level in Brazil

| | CAPM (%) | FF - 3 factor model (%) | FFC - 4 factor model (%) |
|---|---|---|---|
| Low Sent | 15.84 | 6.93 | 5.94 |
| High Sent | 25.08 | 7.26 | 2.97 |

**Note(s):** Table 7 presents the outperforming probability of the funds based on the CAPM, Fama and French (1993), and Carhart (1997) models. The sample was divided according to the sentiment index in low and high sentiment period. The sample period ranges from January 2010 through December 2019 (monthly data)
**Source(s):** Authors' own work

**Table 8.** Outperforming probability adjusted for investor sentiment, Brazil

| | CAPM + sent (%) | FF - 3 factor model + sent (%) | FFC - 4 factor model + sent (%) |
|---|---|---|---|
| Low Sent | 16.83 | 12.21 | 11.22 |
| High Sent | 12.87 | 7.59 | 3.30 |

**Note(s):** Table 8 presents the outperforming probability of the funds based on the CAPM, Fama and French (1993), and Carhart (1997) models adjusted by investor sentiment. The sample was divided according to the sentiment index in low and high sentiment period. The sample period ranges from January 2010 through December 2019 (monthly data)
**Source(s):** Authors' own work

*4.3 Performance and effects of the sentiment index in the US market*

Finally, a complementary analysis using the US sample was performed. The results corroborated those of Bu (2020b). Table 9 shows the results of the alphas found in the CAPM, FF, and FFC model estimations using US mutual funds. According to these results, the performance of the alphas increased when risk factors were added to the analysis. This increase was also observed in the first subperiod. However, in the second subperiod, the probability of positive and significant alphas decreased, and no changes in probability were identified in the third subperiod.

When the sentiment index was included, according to the results presented in Table 10, a reduction in outperformance probability was observed for the entire period in the three estimated models: CAPM, FF, and FFC. This inclusion caused a reduction in the percentage of significant and positive alphas in the first and second subperiods. However, in the third subperiod, a resumption of the increase in this probability was noted.

**Table 9.** Outperforming probabilities based on standard benchmark models for the US

| | CAPM (%) | FF - 3 factor model (%) | FFC - 4 factor model (%) |
|---|---|---|---|
| Whole period | 1.828 | 2.089 | 2.350 |
| 2010–2012 | 0.522 | 1.044 | 1.044 |
| 2013–2015 | 2.089 | 1.044 | 0.261 |
| 2016–2019 | 0.000 | 0.000 | 0.000 |

**Note(s)**: Table 9 presents the outperforming probability of the sample funds based on the CAPM, Fama and French (1993), and Carhart (1997) models. The fund sample includes 385 US mutual funds. The sample period ranges from January 2010 through December 2019 (monthly return data)
**Source(s):** Authors' own work

**Table 10.** Outperforming probabilities on sentiment-adjusted models for the US

| | CAPM + BW (%) | FF – 3 factor model + BW (%) | FFC – 4 factor model + BW (%) |
|---|---|---|---|
| Whole period | 1.828 | 1.044 | 1.044 |
| 2010–2012 | 0.261 | 0.522 | 0.783 |
| 2013–2015 | 1.567 | 0.783 | 0.261 |
| 2016–2019 | 0.000 | 1.044 | 1.567 |

**Note(s)**: Table 10 presents the outperforming probability of the sample funds based on the CAPM, Fama and French (1993), and Carhart (1997) models adjusted by investor sentiment. The fund sample includes 385 US mutual funds. The sample period ranges from January 2010 through December 2019 (monthly return data)
**Source(s):** Authors' own work

Table 11 shows the coefficients of the models estimated using the winner funds from the US sample. It can be seen that the market premium explains the performance of the US funds in the three models. In the FF model, the value factor was significant; this factor was also significant in the FFC model. In all models, the statistical significance of the alphas was identified. Alphas represent the abnormal returns of the winner funds.

Nonetheless, regarding the inclusion of the sentiment factor in the benchmark models with winner funds, it was noted that this factor was statistically significant, as Table 12 shows. These results contrast with those obtained for Brazil, but confirm the results presented by Bu (2020b).

## 5. Discussion

To achieve the objective of the study, the investor sentiment index was estimated following the approach developed by Baker and Wurgler (2006), the risk factors considered the Fama and French (1993) and Carhart (1997) models, and the risk-adjusted performance was evaluated for a sample of equity mutual funds in Brazil. The sample period spanned from January 2010 to December 2019 (monthly data).

The results contrasted with those evidenced in the US, where the sentiment index was an important factor in explaining the occurrence probability of the alpha, especially with winner funds, defined as those displaying a positive and significant alpha at the 5% level. There is evidence that, in Brazil, the returns of winner funds are explained mainly by market risk (beta),

**Table 11.** US winner funds and benchmark models

| Intercept | RMRF | SMB | HML | MOM | $R^2$-adj |
|---|---|---|---|---|---|
| 0.213 | 0.957 | | | | 0.962 |
| (0.057)*** | (0.016)*** | | | | |
| 0.202 | 0.943 | 0.071 | 0.001 | | 0.965 |
| (0.062)*** | (0.017)*** | (0.031)* | (0.043) | | |
| 0.199 | 0.946 | 0.069 | 0.002 | 0.006 | 0.965 |
| (0.063)*** | (0.020)*** | (0.029)* | (0.042) | (0.018) | |

**Note(s):** Table 11 presents the results of the winner fund portfolio based on the CAPM, Fama and French (1993), and Carhart (1997) models. The winner fund portfolio includes all funds with positive alphas, which are statistically significant at a 5% level. ***, **, and * indicate statistical significance at a 0.1%, 1%, and 5% level, respectively. The sample period ranges from January 2010 through December 2019 (monthly data)
**Source(s):** Authors' own work

**Table 12.** US winner funds and sentiment-adjusted models

| Intercept | RMRF | SMB | HML | MOM | SENT | $R^2$-adj |
|---|---|---|---|---|---|---|
| 0.177 | 0.965 | | | | 0.255 | 0.964 |
| (0.053)*** | (0.016)*** | | | | (0.109)* | |
| 0.169 | 0.951 | 0.065 | −0.014 | | 0.259 | 0.966 |
| (0.051)*** | (0.016)*** | (0.039) | (0.030) | | (0.116)* | |
| 0.169 | 0.952 | 0.064 | −0.013 | 0.002 | 0.257 | 0.966 |
| (0.052)*** | (0.019)*** | (0.038) | (0.030) | (0.019) | (0.118)* | |

**Note(s):** Table 12 presents the results of the winner fund portfolio based on the CAPM, Fama and French (1993), and Carhart (1997) models adjusted by investor sentiment. The winner fund portfolio includes all funds with positive alphas, which are statistically significant at a 5% level. ***, **, and * indicate statistical significance at a 0.1%, 1%, and 5% level, respectively. The sample period ranges from January 2010 through December 2019 (monthly data)
**Source(s):** Authors' own work

size, value, and momentum, with the four-factor model presenting a higher adjusted R2. The explanatory capacity of the models is almost the same for the US. For this country, the additional factors of the Fama and French (1993) and Carhart (1997) models did not increase explanatory power; nevertheless, they are statistically significant. These results for Brazil are like those reported by Cavalcante-Filho *et al.* (2021).

It is perceived that a single approach for calculating the sentiment index for the Brazilian market is lacking (Yoshinaga and Castro Junior, 2012; Miranda *et al*., 2018; Santana *et al*., 2020). Further theoretical and empirical discussions are required to determine the most appropriate proxies for this variable. This paper has its limitations. As Baker and Wurgler (2006, 2007) state, there is no perfect proxy for investor sentiment; therefore, the investor sentiment index used in this study may not have captured the sentiment of Brazilian investors accurately, and future research could test other proxies for investor sentiment in Brazil. For example, Bitencourt and Iquiapaza (2024) used the VIX index as an inverted proxy, and Cavalcante-Filho *et al.* (2021) used industry net inflows as a proxy. Nonetheless, future studies could test other data frequencies, such as daily returns or quarterly returns, or whether mutual fund strategies are based on sentiment.

## 6. Conclusion

This study investigated the effect of investor sentiment on mutual fund performance (the occurrence of fund alpha) in the Brazilian mutual fund industry. Overall, the findings suggest that the benchmark models that account for investor sentiment as an additional factor do not adequately capture the outperformance probability of equity mutual funds in Brazil. This result contradicts the evidence from the US. One possible explanation is the high political uncertainty in the Brazilian environment and higher volatility in interest rates during the study period. Therefore, the uncertainty factor might be an important missing pricing factor in the country to be used alongside the sentiment index, as in the study by Bitencourt and Iquiapaza (2024).

This analysis suggests that investor sentiment does not significantly influence Brazilian equity investment fund performance. Instead, other factors may hold more relevance for Brazilian investors in their investment decisions (Cavalcante-Filho *et al*., 2021). Additionally, the potential influence of sentiment on fund performance may not have been fully captured by current measures, indicating the need for further exploration of alternative proxies for sentiment. Proxies for sentiment metrics need to be better explored for emerging markets, as the study by Torre-Torres *et al*. (2021) on the Mexican market also suggests the need for the development of more appropriate sentiment indices for Mexican stock markets, corroborating the findings for the Brazilian market. The study by Anand *et al.* (2021), conducted in five emerging economies, also showed that the existing sentiment measures (including the Baker-Wurgler Index) are insignificant in explaining stock returns in emerging markets.

It is also worth examining whether the positive alphas produced by Brazilian fund managers are attributable to luck rather than skill. Borges and Martelanc (2015) observed varied results concerning returns compared to the Brazilian market average, noting that managers of larger funds demonstrated skill, particularly in the context of the four-factor model. However, they also acknowledge that Fama and French's (2010) findings of a lack of skill support the Efficient Markets Hypothesis (Fama, 1970), which implies that the market is less efficient when there is a possibility of abnormal returns.

Moreover, the effect of sentiment may be linked to the unique characteristics of specific markets and assets. The literature indicates that this influence varies based on factors such as the attributes of fund investors (Jiang and Yuksel, 2019) and the risk profiles and cash flows of the funds (Wang *et al*., 2020), suggesting a complex interplay between investor sentiment and fund performance that future studies may explore.

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